

IRE

DENVER

DECIBEL

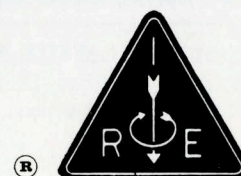


MARCH - 1960

FEATURED IN THIS ISSUE:

RESEARCH AT CU

Published by the Denver Section of the IRE



Volume V, No. 3

The Denver Decibel visits the Electrical Engineering Department of the University of Colorado. Dr. J. C. Twombly, Dr. Frank Barnes, and Dr. C. T. A. Johnk describe the current research activity in the Department.

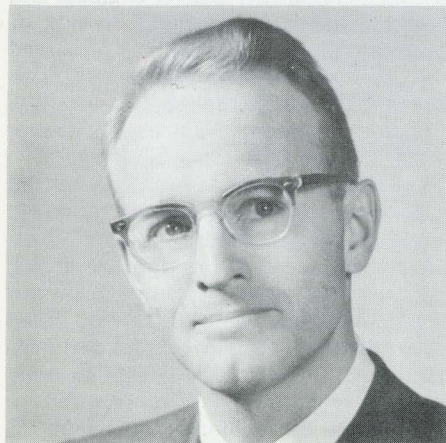
RESEARCH AT CU

PROPERTIES OF HIGH-CHARGE-DENSITY ELECTRON BEAMS

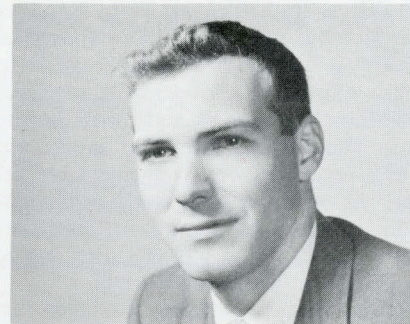
A research project directed by Dr. J. C. Twombly and sponsored by the Office of Naval Research is currently devoted to a study of some properties of high-charge-density electron beams. A drifting beam of charged particles—that is, a beam in which no longitudinal electric fields exist—has a transverse potential profile with a depressed center due to the negative space-charge present. An increase in injected current density deepens this depression which, in turn, lowers electron velocities and thus increases charge density and potential depression still more. At certain critical values this process becomes cumulative and results in an abrupt shift of energy level in the beam.

The initial objective of this analytical and experimental exploration is the determining of the speed of the energy-level transient and its propagation along the beam. Already the instability threshold and the succeeding stable state have been calculated for each of the more important beam geometries. Noise properties of the beam in both states have also been examined.

It is expected that as the basic mechanics of this beam behavior are further mastered, possible applications will become increasingly evident. Already being considered as applications are high-speed electronic switching, particle acceleration accompanying the transient's propagation, and the production of oscillation whose frequency could be governed by beam length.



THE DENVER DECIBEL



Several new research programs are currently getting underway in the Electrical Engineering Department under the direction of Dr. Frank Barnes.

BEAM-TYPE MASERS

The largest of these is a program for the development of a beam-type maser using hydrogen cyanide at a wavelength of 3.5 mm. Previous work with beam-type masers using ammonia at wavelengths of about 1.25 cm has provided a microwave signal source which is useful as a frequency standard.

Work has already started on the microwave interferometer which will be used as a resonant structure for the maser. This work is being supported by a grant from the University Council on Creative Activity and Research and the Electrical Engineering Department. It is planned that a millimeter wave maser will be in operation before the end of the coming summer. It is hoped that the development of this maser with a shorted wavelength will provide an even better frequency standard as well as an understanding of the techniques required in working with wavelengths of a few tenths of a millimeter.

TUNNEL DIODES

A second project which is just commencing is the study of tunnel diode circuit properties. This project will include an investigation of the temperature stability of tunnel diode parameters as well as the possible use of the diodes in the development of stable oscillator circuits. So many potential uses exist for tunnel diodes that the scope of this project cannot yet be anticipated.

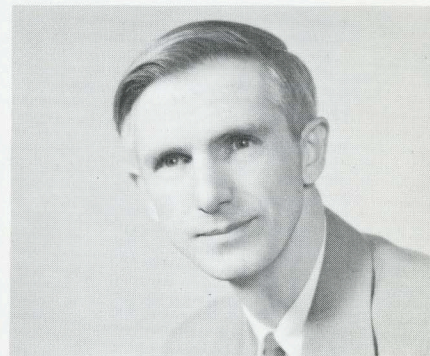
NEW PROJECTS

Other projects which are receiving some attention include the possibilities of developing a large very non-linear capacitor and of the generation of subharmonic frequencies with a variable reactance.

STUDIES OF VERTICAL MONOPOLE ANTENNAS

A research group directed by Dr. C. T. A. Johnk and sponsored by the Air Force Cambridge Research Center is currently engaged in *Impedance and Pattern Studies of Vertical Monopole Antennas*.

For the study, the antennas are placed above finite conducting ground disks which are in turn set flush with a poorly conducting flat earth. By using microwave frequency signals, the system has been scaled down such that a flat earth region over a hundred wavelengths square could be built right in the laboratory. The lossy earth is being simulated by a tank of ordinary tap water which, at microwave frequencies, is a moderately poor electrical conductor. The monopole antenna is fed by means of a coaxial line from underneath the tank. A small flat brass disk placed at the water surface acts as an extension of the outer conductor of the coaxial line, while the monopole antenna is simply an extension of the inner conductor. Antenna impedance and pattern tests are being made for various disk diameters and monopole lengths in an effort to justify an approximate field theory.



As an outgrowth of this study, a new precision technique for slotted-line impedance measurements at X-band was devised by R. J. King of the University of Colorado. This technique is an outgrowth of earlier work done by Dr. R. Mittra of the University of Illinois. Enlarged Smith charts of four times normal size had to be used to plot the impedance data for the monopole system. Accuracies of better than 1/2 percent are being obtained.

Future studies will concentrate on variations of this technique using, for example, a radial-wire ground system in place of the solid brass disks. Studies will also be focused on the wave phenomena associated with sudden discontinuities in the constants of an earth wave-propagating system.



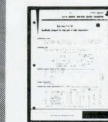
ORDER TEXAS INSTRUMENTS SEMICONDUCTORS FROM DENVER ELECTRONIC SUPPLY



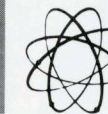
YOUR AUTHORIZED TI DISTRIBUTOR

For immediate off-the-shelf delivery on any of TI's complete line of use-proved, guaranteed semiconductors and components, order today in the following quantities . . . factory prices:

silicon transistors, germanium transistors, silicon diodes and rectifiers, and carbon film resistors: 1-999 • *sensistor* silicon resistors: 1-499 • *tan-TI-cap* tantalum capacitors: 1-99



CALL OR WRITE for complete specification sheets on any of TI's broad line of semiconductors and components.



DENVER ELECTRONIC SUPPLY CO.

1254 Arapahoe Street • Denver 4, Colorado

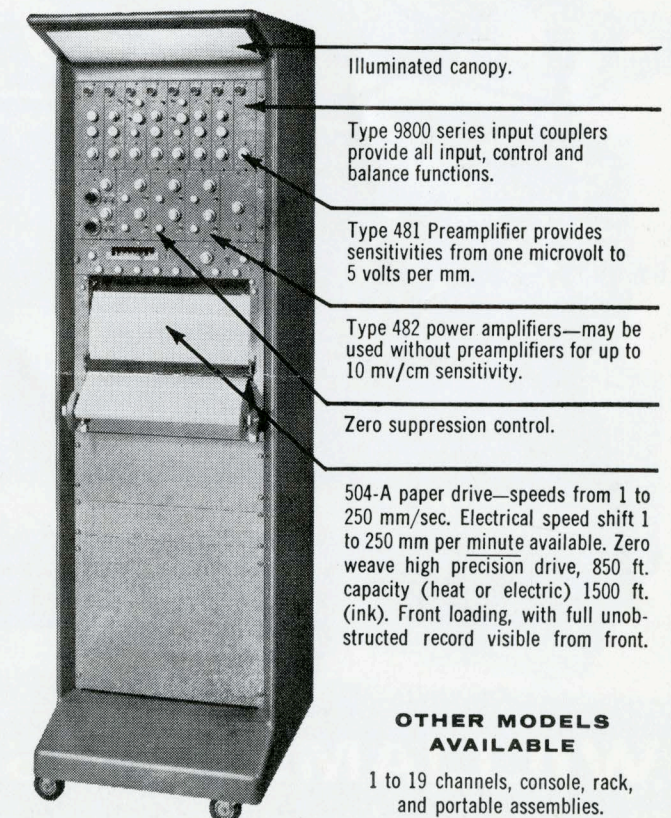
Tel: AM 6-1671

**the most versatile...most sensitive
direct writing recorder available!**

THE OFFNER ALL-TRANSISTOR TYPE R DYNOGRAPH

Whatever your application for direct writing records . . . investigate the ability of the Offner Type R Dynograph to do the job *better* and more *simply*. Its features of superiority are unmatched!

- *stable d-c sensitivity of one microvolt per mm*
- *true differential input*
- *high input impedance*
- *response to beyond 150 cps*
- *reluctance, differential transformer, strain gages with a-c or d-c excitation, thermocouples, etc., used with all preamplifiers*
- *deflection time less than 1.5 milliseconds (2.5 ms with preamplifiers)*
- *fixed precision calibration*
- *instant warm-up*
- *precision source for d-c and 400 cycle excitation, self-contained*
- *zero suppression, twenty times full scale, both directions*



**OTHER MODELS
AVAILABLE**

1 to 19 channels, console, rack, and portable assemblies.

Represented by GENE FRENCH COMPANY

3395 South Bannock
Englewood, Colorado
SU 9-3551

OFFNER ELECTRONICS INC.

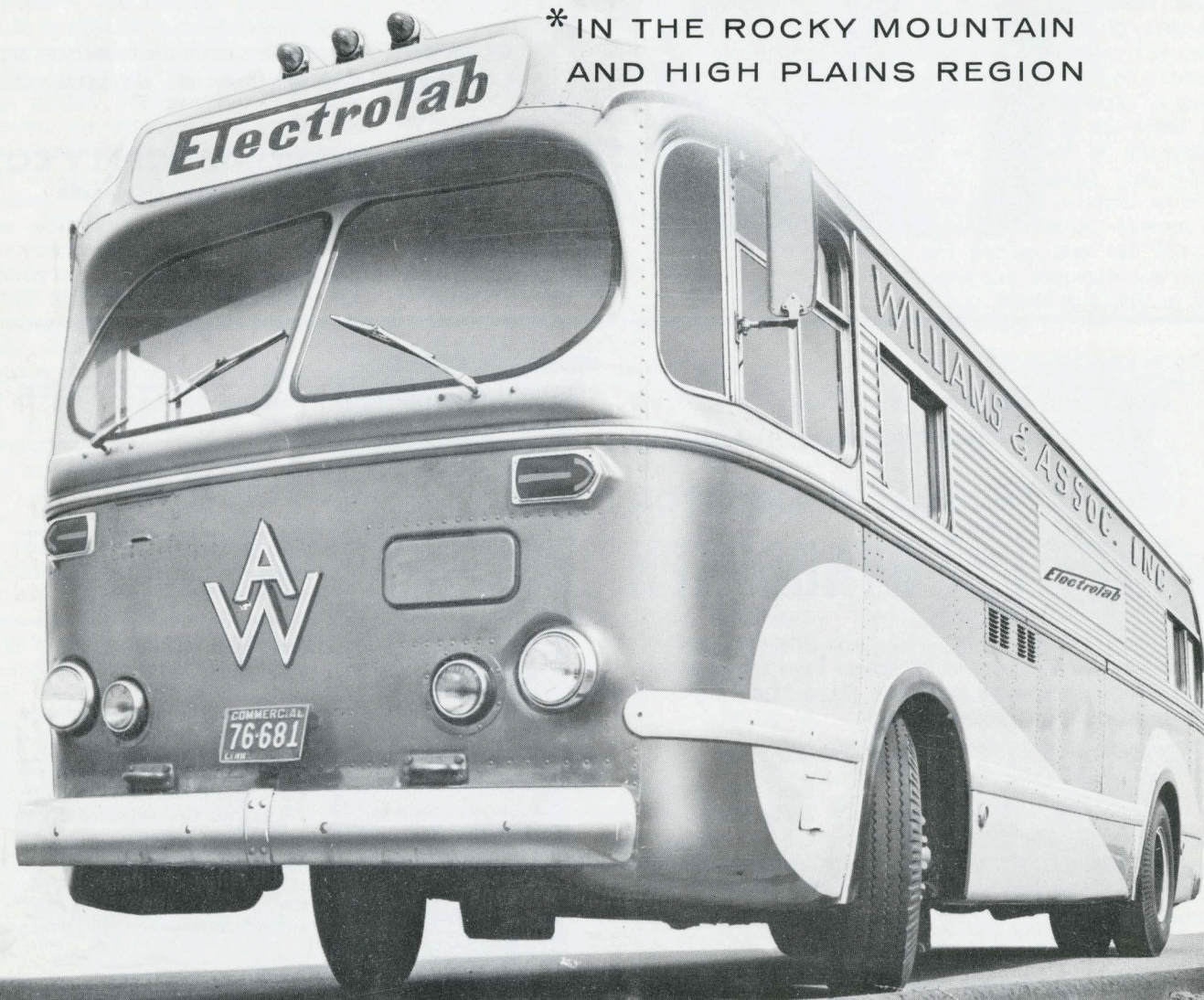
3908 River Road, Schiller Park, Ill. (Suburb of Chicago)

THE DENVER DECIBEL

We're not selling busses. We are completely refitting our spacious 35 ft. Electrolab. That's our word for the Williams traveling electronic laboratory—a convenient cruiser well stocked with the latest and best of instrumentation and components. Not only that. You've never seen such complete working exhibits as we're planning. In air-conditioned comfort, you'll see hooked-up systems, cutaways, working models to show you short cuts to simplify your engineering problems. Ample display racks hold detailed literature and spec sheets you can take with you. In short, the Electrolab has everything—including a small kitchen sink. Sure, this will all take time. But we at Williams wager it's worth the wait. You'll think so, too, when you see it. Electrolab—coming to your city soon.

Electrolab

ANOTHER FIRST BY WILLIAMS
* IN THE ROCKY MOUNTAIN
AND HIGH PLAINS REGION



WILLIAMS & ASSOCIATES, INC.

APPLICATION ENGINEERING • INSTRUMENTATION CONSULTING

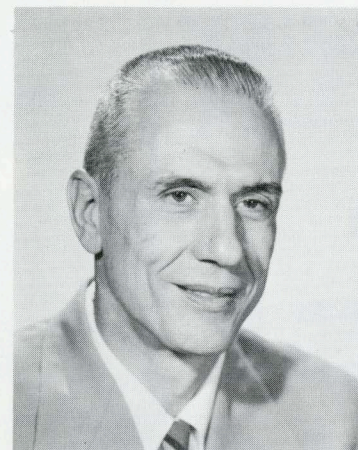
DENVER 22, COLORADO
2261-63 South Albion Street
SKyline 6-9403—TWX: DN 134

ALBUQUERQUE, NEW MEXICO
Branch Office: 3221 Silver Ave., S.E.
ALpine 5-9632 and 5-9674—TWX: AQ 365

SALT LAKE CITY, UTAH
320 East Fourth South
EMpire 4-6844

PGAP NEWS

By Wm. Coombs



CHAIRMAN PGAP

A new policy of the National Bureau of Standards—to solicit outside papers for the *NBS Journal of Research*—is clearly in evidence in the January issue of the section on Radio Propagation. Of the thirteen papers in this issue nine are from authors outside of NBS—including one each from England, Japan, and Canada.

This section of the Journal, edited by Dr. James R. Wait of the NBS Boulder Laboratories, was particularly designed to serve as a national publication and has included outside authors in every issue since its first appearance in July 1959.

"Prior to this," according to Dr. Wait, "no single journal was primarily devoted to reporting research in radio propagation. To meet the growing interest in this field, the Journal on Radio Propagation (one of four new sections of the Journal of Research) supplements the work of NBS by reporting outstanding papers in radio propagation from research workers in other laboratories. This policy has been developed after consultation with officers of the Institute of Radio Engineers and PGAP."

Subject matter of the January issue ranges from the effect of high-altitude nuclear explosions on radio noise to the refinement of a mathematical model used in studying the propagation of radio energy around a spherical earth.

Full title of the bi-monthly technical journal is *Journal of Research of the National Bureau of Standards, Section D, Radio Propagation*. It is available through subscription only (\$4.00 per year) which may be placed through the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

MARCH 21-24 SET FOR IRE MEETING

March 21 through 24 have been selected as the dates for the 1960 IRE International Convention, which will again be held at the Waldorf-Astoria Hotel and New York Coliseum in New York City. More than 60,000 engineers and scientists from 40 countries are expected to attend what has become the world's largest technical meeting and exhibition.

A comprehensive program of 275 papers, covering the most recent developments in the fields of all 28 IRE Professional Groups, will be presented in 54 sessions at the Waldorf-Astoria and the Coliseum. The high point of the program will be a special symposium on "Electronics - Out of This World" to be held Tuesday evening, March 22. The symposium will be conducted by Ernst Weber, President of the IRE for 1959, and a panel of leading space electronics experts. The complete program will be announced in January.

The Radio Engineering Show, filling all four floors of the Coliseum, will accommodate approximately 850 exhibitors. Some \$15,000,000 worth of the latest electronic equipment will be on display, most of it for the first time.

Inexpedient—Not calculated to advance one's interests.

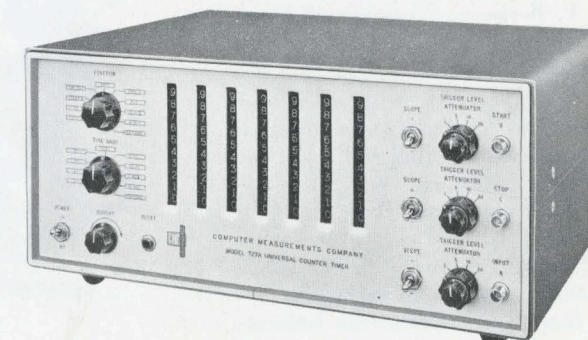
10 mc. ALL SOLID STATE!

COMPUTER - MEASUREMENTS COMPANY

- ★ Lightweight—27 lbs.
- ★ Low power consumption—46 watts
- ★ DC gating techniques adaptable to remote switching of control functions
- ★ Completely transistorized
- ★ Sensitivity better than 0.25 v rms
- ★ DC to 10 mc
- ★ 0.1 μ sec to 10^7 sec

CMC
700 Series

the only major breakthrough in counting, timing, and frequency measuring equipment in the past ten years



Model 727A Universal Counter-Timer

Represented by:

HYTRONIC MEASUREMENTS, INC.

DENVER, COLORADO
1295 South Bannock Street • PEarl 3-3701

ALBUQUERQUE, NEW MEXICO
211 Sierra, S.E., Box 8394 Station C • ALpine 5-0669

SALT LAKE CITY, UTAH
2022 South Main Street • INgersoll 6-4924

IRE International Convention

The Institute of Radio Engineers has announced a change in the title of its annual convention from IRE National Convention to the IRE International Convention. The change reflects the fact that the IRE now has 22 Sections and 6,000 members outside the United States.

March 21 through 24 have been selected as the dates for the 1960 IRE International Convention, which will again be held at the Waldorf-Astoria Hotel and New York Coliseum in New York City. More than 60,000 engineers and scientists from 40 countries are expected to attend what has become the world's largest technical meeting and exhibition.

A comprehensive program of 275 papers, covering the most recent developments in the fields of all 23 IRE Professional Groups, will be presented in 54 sessions at the Waldorf-Astoria and the Coliseum. The high point of the program will be a special symposium on "Electronics—Out of This World" to be held Tuesday evening, March 22. The symposium will be conducted by Ernst Weber, President of the IRE for 1959, and a panel of leading space electronics experts.

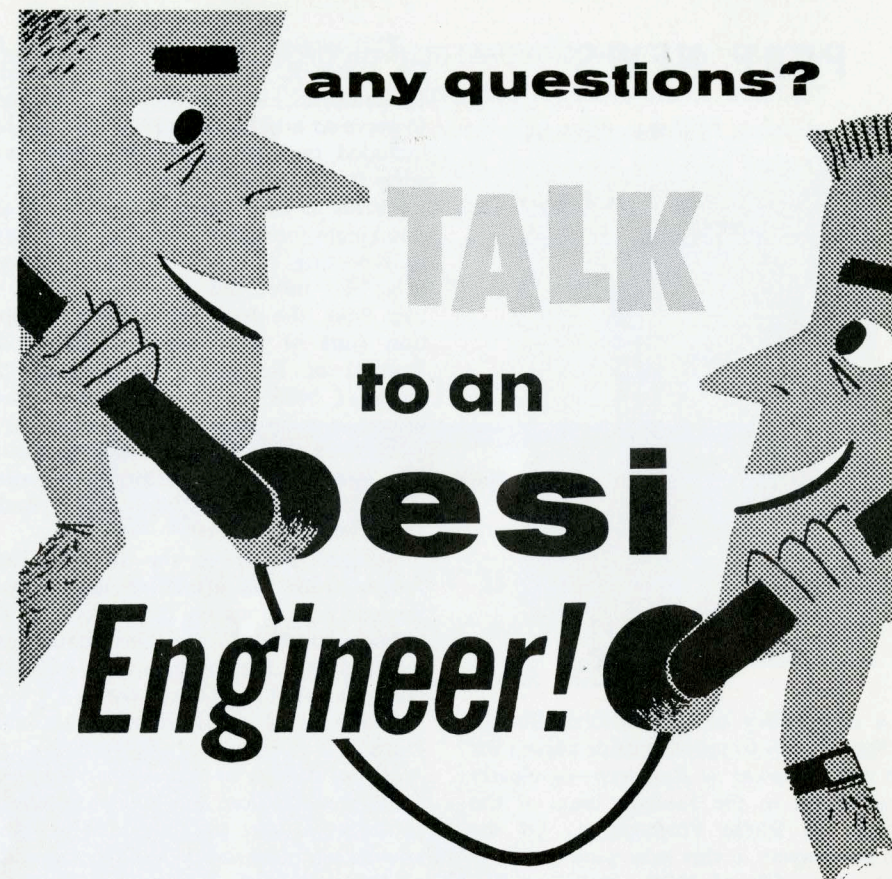
The Radio Engineering Show, filling all four floors of the Coliseum, will accommodate approximately 850 exhibitors. Some \$15,000,000 worth of the latest electronic equipment will be on display, most of it for the first time.

The convention will get under way with the Annual Meeting of the IRE on Monday morning, March 21. Dr. Lloyd V. Berkner, President of Associated Universities, Inc., will be the featured speaker.

The social events will include a "get-together" cocktail party Monday evening and the annual IRE banquet Wednesday evening, both in the Grand Ballroom of the Waldorf. The banquet will feature the presentation of IRE Awards for 1960, including the Medal of Honor to Harry B. Nyquist, former Bell Telephone Laboratories engineer, and the Founders Award to Haraden Pratt, Secretary of the IRE.

Absurdity—A statement of belief manifestly inconsistent with one's own opinion.

THE DENVER DECIBEL



The ESI way—an engineer-staffed sales-service department as close as your phone! No long distance charges. Just dial your local operator. Ask for the number listed below. You'll be talking *right now* to a man who knows ESI precision instruments and components from A to Z. When you want precise facts—the technical information and service that *only* an experienced engineer can provide, use your telephone. Get the answers fast, accurately and first-hand from an ESI applications engineer!



PHONE

Factory

DIRECT

at no cost to you!

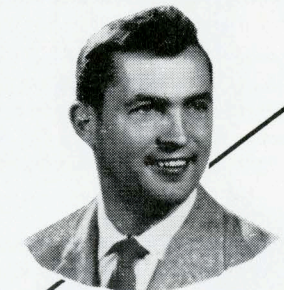
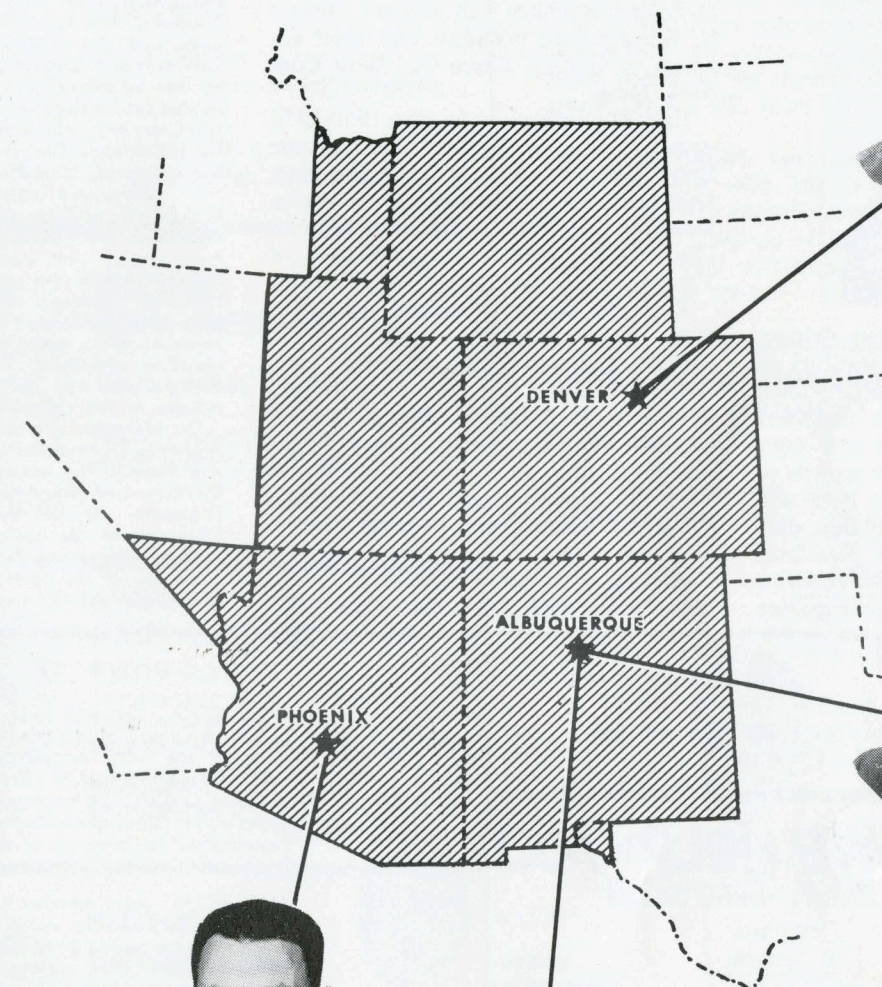
Denver, Colorado
dial operator and ask for
ENTERPRISE 3331
(No Long Distance Charges)
If we are not listed in your exchange,
Call Portland, Oregon collect
CHERRY 6-3331

Impedance Bridges and Accessories
Decade Voltage Dividers
Decade Resistors and Capacitors
ESIA Computers

ELECTRO-SCIENTIFIC INDUSTRIES, INC.
formerly
ELECTRO-MEASUREMENTS, INC.
7524 S.W. MACADAM • PORTLAND 19, OREGON

PAGE 8

CUSTOMER SERVICE through ENGINEERING know-how!



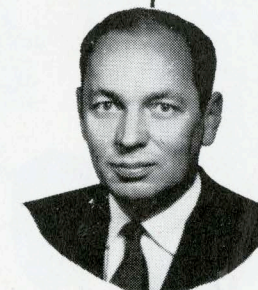
HUGH HILLEARY



JOE SHROCK



BILL RECORD



GENE FRENCH



the gene FRENCH company

ALBUQUERQUE

120 San Pedro Dr., S.E.
Albuquerque, New Mexico
AMherst 8-2478
TWX AQ-70

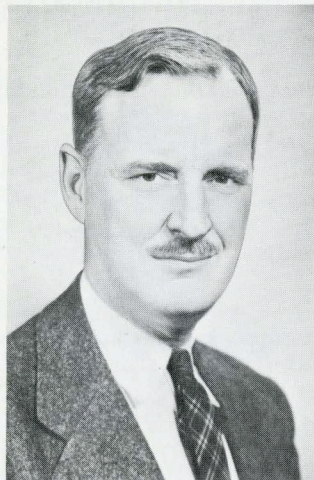
DENVER

3395 S. Bannock St.
Englewood, Colorado
SUnset 9-3551
TWX Englewood, Colo. 106

PHOENIX

224 S. Hinton Avenue
Scottsdale, Arizona
WHitney 6-3504
TWX Scottsdale, Ariz. 109

INSTITUTE OF RADIO ENGINEERS ELECTS OFFICERS FOR 1960



Dr. McFarlan succeeds Ernst Weber, president of the Polytechnic Institute of Brooklyn, as head of the international society of 76,000 electronics engineers and scientists.

In recognition of the rapid growth of the institute's activities, both here and abroad, the IRE will for the first time in its history have two vice presidents in 1960, one residing in North America and the other from abroad. The vice

president representing overseas countries for 1960 will be J. A. Ratcliffe, head of radio research at the Cavendish Laboratory in Cambridge, England. The vice president representing North America will be J. N. Dyer, vice president of the Research and Engineering Division of Airborne Instruments Lab., Melville, N.Y. Dyer and Ratcliffe will succeed Donald B. Sinclair, vice president and chief engineer of General Radio Co., West Concord, Mass.

Elected as directors for the 1960-1962 term are W. G. Shepherd, head of the Department of Electrical Engineering, University of Minnesota, Minneapolis, Minn. and George Sinclair, Professor of Electrical Engineering, University of Toronto, Toronto, Canada.

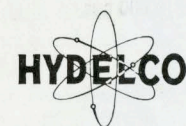
Regional Directors elected for 1960-1961 are as follows: Region 1—J. B. Russell, Jr., manager, Electronics Lab., General Electric Co., Syracuse, N. Y.; Region 3—B. J. Dasher, director, School of Electrical Engineering, Georgia Institute of Technology, Atlanta, Ga.; Region 5—R. E. Moe, manager of engineering, Receiving Tubes Dept., General Electric Co., Owensboro, Ky.; Region 7—C. W. Carnahan, technical assistant to the president, Varian Associates, Palo Alto, Calif.

RONALD L. McFARLAN was born on March 8, 1905, in Cincinnati, Ohio. He attended the University of Cincinnati and subsequently the University of Chicago, from which latter institution he received the Ph.D. in physics in 1930. His next two years were spent as a National Research Council Fellow in physics at Harvard University, and were followed by three more years as an instructor at Harvard.

Dr. McFarlan's industrial career has included positions as chief physicist of the United Drug Company, and later the B. B. Chemical Company, and also as director of research for the Bulova-Watch Company. For about eight years he was executive assistant to the director of equipment engineering, Raytheon Manufacturing Company, and is presently a consultant to the DATAmatic Corporation and the Raytheon Manufacturing Company.

Dr. McFarlan's early professional work was in the fields of X-ray diffraction and scattering, ultraviolet spectroscopy, and electronic instrument design and navigation. He has been associated with the management of projects including electronic digital computers, radar, automatic guidance and control, microwave communication, sonar echo ranging, and depth sounding equipment. He is the holder of several patents, and the author of a number of articles in the electronic and optical fields.

Dr. McFarlan is a member of Sigma Xi, the American Physical Society, the American Chemical Society, the Institute of the Aeronautical Sciences, and the American Society of Naval Engineers. He has been Vice-Chairman and Chairman of the Boston Chapter of the Professional Group on Engineering Management, Chairman of the Boston Section, and a Senior Member of the IRE since 1951.



MAY WE HELP YOU?

MEMBER

Dick Hyde

Ben Burdett

Verne Linsley

Paul Wright

Leo Davis

Jack Walter

Bill Morley

Warren Tandy

Dick Hyde, Jr.

Gail Hess

Salt Lake City
2803 Conner Street
INgersoll 7-5763
TWX SU 188U

Phoenix
2902 W. Villa St.
APplegate 8-2266
TWX PX 88

Albuquerque
5206 Constitution Ave., NE
AMherst 8-1111
TWX AQ 388

DENVER
(Main Offices and Warehouse)
888 So. Lipan St.
WEst 6-3456
TWX DN 888

UTAH

COLORADO

ARIZONA

NEW MEXICO

TEXAS

IDAHO

WYOMING

MONTANA

NEBR.

A well-organized, well-qualified team of sales specialists

HYDE ELECTRONICS CO.
MANUFACTURERS' REPRESENTATIVES
Serving the Rocky Mountain Area since 1938

THE DENVER DECIBEL

YOU OUGHT TO JOIN THE IRE

BECAUSE: You will receive PROCEEDINGS OF THE IRE every month, the magazine recognized as one of the most important contributions to the engineering progress of electronics. The publication of the advances in engineering fundamentals and applied art constitute its best-known and most firmly established function. It is world-recognized as the publication organ of those advances.

BECAUSE: As a member of the IRE, you are eligible to join one or more IRE PROFESSIONAL GROUPS formed in 23 technical fields. Group membership provides an opportunity to broaden knowledge in your specialty field by association with other engineers with the same specialized interest. You will receive their technical publications, TRANSACTIONS, containing specialized articles in your particular field of interest.

BECAUSE: As an IRE member, you may serve on COMMITTEES, learn what others are doing, and contribute your own knowledge. The Standardization work of these committees has formed the basis for a number of important legal and governmental actions concerning the rating and measuring of radio equipment.

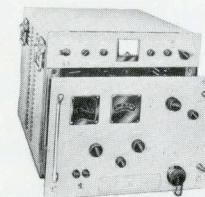
BECAUSE: As a member of a local IRE SECTION, you may attend, and participate in, meetings where matters of particular technical interest in your locality are discussed by people who know them best.

BECAUSE: With your IRE membership comes professional PRESTIGE. IRE membership, particularly in the higher grades, is universally recognized as a recommendation of professional attainment.

BECAUSE: As an IRE member, you will receive a copy of the ANNUAL IRE DIRECTORY, containing names and addresses of over 40,000 members, together with a listing of 3,500 firms in the field and the products they make.



MICROWAVE SIGNAL GENERATION EQUIPMENT

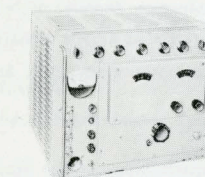


Model PMR

UHF SIGNAL GENERATOR

400 to 1,000 mc
Single unit covers the entire frequency range.

Interchangeable modulators:
Pulse (capabilities shown right) or FM.

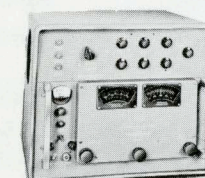


Models
MSG-1 and MSG-2

MICROWAVE SIGNAL GENERATORS

950 to 4,600 mc

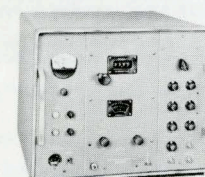
MSG-1 950 to 2,000 mc
MSG-2 2,000 to 4,600 mc



Model PMX

MICROWAVE SIGNAL GENERATOR

4,450 to 11,000 mc
Two interchangeable plug-in or r-f generator units cover the frequency range.
Basic Unit GB-2: Power Supply and Modulator
Generator Unit G-48: 4,450 to 8,000 mc
Generator Unit G-711: 6,950 to 11,000 mc

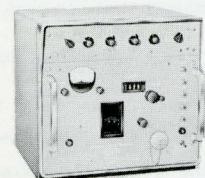


Model MSG-34

ULTRA-BROADBAND MICROWAVE SIGNAL GENERATOR

4,200 to 11,000 mc in one instrument

Equivalent in range to two signal generators. Direct-reading DIGITAL Frequency Indicator.



Model PMK

MICROWAVE SIGNAL GENERATOR

10,000 to 21,000 mc
Two interchangeable plug-in generator units cover the frequency range.
Basic Unit GB-3: Power Supply and Modulator
Generator Unit G-1015: 10,000 to 15,500 mc
Generator Unit G-1521: 15,000 to 21,000 mc

POLARAD offers a fully integrated line of Microwave Generating Equipment for measuring: receiver sensitivity, noise figure, signal to noise ratio, image rejection, beacon sensitivity, bandwidth, standing wave ratio, antenna gain and pattern, conversation gain or loss, attenuation, filter characteristics and multipulsed systems such as beacons, DME, Tacan.

ALL MODELS FEATURE: Continuously variable attenuator calibrated directly in -dbm. Internal modulation, pulse and FM. Internal square wave modulation. Synchronization outputs, delayed and undelayed. Provisions for external multipulse and pulse modulation. Rugged construction. Non-contacting short type choke in klystron cavity.

SPECIFICATIONS FOR SIGNAL GENERATORS SHOWN AT LEFT

(PMR, MSG-1, MSG-2, PMX, MSG-34 and PMK)

Frequency Accuracy: $\pm 1\%$
Calibrated Power Output: 400 to 11,000 mc: 1 milliwatt
10,000 to 21,000 mc: 10 milliwatts

MODULATION CAPABILITIES

	400 to 4600 mc	4200 to 21,000 mc
Internal Square Wave:	40 to 4,000 pps	10 to 10,000 pps
Internal Pulse Modulation:		
Width:	0.5 to 10 μ sec	0.2 to 10 μ sec
Repetition Rate:	40 to 4,000 pps	10 to 10,000 pps
Delay:	2.5 to 300 μ sec	2 to 2,000 μ sec

CODE MODULATED MULTI-PULSE MICROWAVE SIGNAL GENERATOR

Model B
950 to 10,750 mc

For testing beacons, missiles, radar, navigational systems such as DME, Tacan, H.F. Loran.

FEATURES:

Four interchangeable oscillator units. Five independently adjustable pulse channels each featuring variable pulse width and delay. Built-in precision oscilloscope.

SPECIFICATIONS

Tuning Unit No.	Frequency Range
BL-1	950 to 2,400 mc
BS-1	2,150 to 4,600 mc
BC-1	4,450 to 8,000 mc
BX-1	7,850 to 10,750 mc

WRITE FOR COMPLETE SPECIFICATIONS AND PRICES

Manufacturers' Representatives

McLOUD & RAYMOND COMPANY

5403 East Evans - P. O. Box 8848 - Denver 22, Colorado - SKyline 6-1589 - 6-1580

Section Meeting

March 17, "Magnetic Materials at Radio and Microwave Frequencies" by Robert D. Harrington, 8:00 P.M., Boulder Laboratories Auditorium, Boulder, Colorado. Refreshments and opportu-

ity to see the Boulder Laboratories work on radio materials.

April 28, Tour of U. S. Air Force Academy (Details to be arranged) and Student night papers.

1960 CONFERENCE ON ELECTRONIC STANDARDS AND MEASUREMENTS

The second national Conference on Electronic Standards and Measurements, co-sponsored by the National Bureau of Standards, The Institute of Radio Engineers' Professional Groups on Instrumentation and Microwave Theory and Techniques, and the American Institute of Electrical Engineers, will be held June 22-24, 1960, at the National Bureau of Standards Laboratories, Boulder, Colorado.

Since the first meeting in 1958, there has been an intensified interest in the development of standard and measurement techniques, stemming in the main from defense requirements and the specialized needs of the space age. Many new laboratories have come into existence as a part of standards and calibrations programs within industry and among defense agencies. The upsurge in the need for greater accuracy and extended range, as well as wholly new measurement techniques, has multiplied the problems of those working in the field of electronic standards.

The 1960 Conference will provide a broad review of the most recent developments and accompanying problems which obtain throughout the useful spectrum of contemporary application.

Six sessions are planned on the following subjects—

- 1) Current and Future Problems in Electronic Standards: Traceability of calibrations to National Standards, anticipated requirements and overcoming adverse environments.
- 2) Direct-Current and Low-Frequency Standards and Calibrations: Current, voltage, power, resistance, impedance and attenuation.
- 3) Methods of Measurement for Materials: Complex permittivity and permeability, tensor permeability and tensor conductivity.
- 4) Frequency and Time Standards: Molecular, atomic and quartz standards; measurement and utilization.
- 5) Microwave Standards and Calibrations: High and low power, phase shift, impedance, attenuation and noise.
- 6) High-Frequency Standards and Calibrations: Voltage, current, power, impedance, attenuation, phase shift and field strength.

PAPERS FOR WESCON

Authors wishing to present papers at the 1960 Western Electronic Show and Convention technical sessions to be held August 23-26 should register their interest by May 1. Required are 100-200 word abstracts, together with complete texts or detailed summaries. They should be sent to the Chairman of the Technical Program, Richard G. Leitner, WESCON Business Office, 1435 South La Cienega Blvd., Los Angeles 35, Calif.

Selection of papers for the program will be made before June 1 and authors will be advised of acceptance or rejection by that date.

There will again be an IRE-WESCON Convention Record published in advance of WESCON by the National Headquarters of the Institute of Radio Engineers.

76 Top Engineers Named IRE Fellows

Seventy-six leading radio engineers and scientists from the United States and other countries were named Fellows of the Institute of Radio Engineers by the Board of Directors at its November meeting held in New York City. The grade of Fellow is the highest membership grade offered by the IRE and is bestowed only by invitation on those who have made outstanding contributions to radio engineering or allied fields.

Presentation of the awards will be made by IRE Sections all over the world wherever the recipients reside. Recognition of the awards will be made by the President of the IRE at the annual banquet on March 23, 1960, at the Waldorf-Astoria in New York City during the 1960 IRE International Convention.

Heaven—A place where the wicked cease from troubling you with talk of their personal affairs, and the good listen with attention while you expound on your own.

DATES TO REMEMBER

1960 Date—Meeting—Place Sponsored by
 March 21-24 IRE International Convention, Coliseum & Waldorf, Astoria Hotel, New York City All PG's
 March 24-25 1st Natl. Symp. on Human Factors in Electronics, Bell Tel. Labs. Aud., 463 West St., New York, N.Y. PGHFE
 (Entrance at 55 Beithune St.)
 April 3-8 6th Nuclear Congress, N. Y. Coliseum, New York City EJC:PGNS
 April 12-13 14th Annual Spring Tech. Conf. on Electronic Data Processing, Hotel Alms, Cincinnati, Ohio. Cinn. Sec. ARS
 April 18-19 Conf. on Automatic Techniques, Sheraton Cleveland Hotel, Cleveland, Ohio PGIE:AIEE ASME
 April 19-21 In/natl. Symp. on Active Networks & Feedback Systems, Eng. Soc. Bldg., Auditorium, N.Y.C. PGCT:PIB:ONR:OSR:USASROI
 April 20-22 SWIRECO S.W. IRE Reg. Conf. & Elec. Show & Natl. PG on Med. cal Electronics Conf., Shamrock-Hilton Hotel, Houston, Texas Region 6 PGME
 May 2-4 Natl. Aero. Electronics Conference, Biltmore & Miami Hotels, Dayton, Ohio PGANE Dayton Section
 May 2-5 URSI-IRE Spring Meeting, Sheraton Hotel, Washington, D. C. URSI:PGCT PGAP:PGI PGMT&T PGIT
 May 3-5 Western Joint Computer Conf., San Francisco, Calif. PGEC:AIEE ACM
 May 9-11 PGMTT Natl. Symp., Hotel Del Coronado, San Diego, Calif. PGMTT
 May 10-12 Electronic Components Symp., Hotel Washington, Washington, D. C. PGCP:AIEE EIA:WEMA
 May 23-25 7th Regional Tech. Conf. & Trade Show, Olympic Hotel, Seattle, Wash. Region 7
 June 20-21 Chicago Spring Conf. on Broadcast & TV Receivers, Graemere Hotel, Chicago, Ill. PGBTR
 June 22-24 Electronic Standards & Measurements Conf., NBS Labs., Boulder, Colo. PGI:NBS AIEE
 June 27-29 Natl. Conv. on Military Elec., Sheraton Park Hotel, Washington, D. C. PGMIL
 June 25-July 9 1st Congress Internatl. Fed. of Automatic Control, Moscow, USSR PGAC et al
 July Internatl. Conf. on Elec. Engineering Education, Sagamore Conf. Center, Syracuse Univ., Syracuse, N. Y. PGIE:AIEE:ASEE
 Aug. 23-26 WESCON, Ambassador Hotel, Memorial Sports Arena, Los Angeles, Calif. LA & SF Sections:WCEMA
 Aug. 29-Sept. 3 Internatl. Information Theory Meeting, London, England PGIT:IEE
 Sept. 7-9 Joint Automatic Control Conf., M.I.T., Cambridge, Mass. IRE-PGAC:ASME:ISA:AIEE:AICHe
 Sept. 15-16 8th Annual Eng. Mgt. Conf., Morrison Hotel, Chicago, Ill. PGEM:AICHe:ASME:ASCE:AIEE:AIEE
 Sept. 19-22 Natl. Symp. on Space Elec. & Telemetry, Shoreham Hotel, Washington, D. C. PGSET
 Sept. 21-22 Industrial Electronics Symp. PGIE:AIEE
 Oct. 3-5 6th Natl. Communications Symp., Hotel Utica & Utica Memorial Auditorium PGCS:Rome-Utica Section
 Oct. 10-12 National Elec. Conference, Chicago, Ill. IRE:AIEE EIA:SMPTE
 Oct. 2nd Natl. Ultrasonics Symp., Boston, Mass. PGUE
 Oct. Eng. Writing & Speech Symp., Chicago, Ill. PGEWS
 Oct. 19-21 Symp. on Space Navigation, Deshlu-Hilton Hotel, Columbus, Ohio PGSET
 Oct. 24-26 East Coast Aero & Nav. Elec. Conf., Lord Baltimore Hotel, Baltimore, Md. PGANE:Baltimore Section
 Oct. 26-28 Conf. on Magnetic Amplifiers, Bellevue-Stratford Hotel, Philadelphia, Pa. AIEE:PGIE
 Oct. 27-29 1960 Electron Devices Meeting, Shoreham Hotel, Washington, D. C. PGED
 Oct. 31-Nov. 1-2 13th Annual Conf. on Elec. Tech. in Medicine & Biology, Sheraton Park Hotel, Washington, D. C. PGME:AIEE:ISA
 Oct. 31-Nov. 1-2 Radio Fall Meeting, Syracuse Hotel, Syracuse, N. Y. IRE:EIA
 Nov. 14-16